

**R13**

Code No: 115ER

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B. Tech III Year I Semester Examinations, March - 2017****THERMAL ENGINEERING – II**

(Common to AME, ME)

**Time: 3 hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A****(25 Marks)**

- 1.a) Explain the classification of fuels. [2]
- b) Explain regenerative cycle with neat sketch. [3]
- c) Differences between external fired and internal fired boilers. [2]
- d) State differences between high-pressure and low pressure boilers? [3]
- e) Draw velocity triangle for 50% reaction steam turbine. [2]
- f) Discuss the merits and demerits of surface condensers over jet condensers. [3]
- g) Write briefly about the usage of gas turbines. [2]
- h) Distinguish between an ideal gas turbine plant and an actual gas turbine plant. [3]
- i) List out the factors which are to be considered for the comparison of different types of rockets? [2]
- j) List out the desirable properties required for liquid propellant rockets. [3]

**PART - B****(50 Marks)**

- 2.a) What are the advantages and disadvantages of regenerative cycle over simple Rankine cycle?
- b) Percentage composition of sample of liquid fuel by weight is, C=88.8% and H<sub>2</sub> = 15.2% Calculate i) the weight of air needed for combustion of 1kg of fuel, ii) the volumetric composition of product of combustion if 15% excess air supplied. [5+5]

**OR**

- 3.a) Compare Rankine cycle and Carnot cycle.
- b) Calculate the height of a chimney required to produce a draught equivalent to 1.7cm of water if the flue gas temperature is 270°C and ambient temperature is 22°C and minimum amount of air per kg of fuel is 17kg. [5+5]
- 4.a) Explain with help of neat diagrams, Cochran boiler, fire tube boilers.
- b) Explain with the help of neat diagram Lancashire boiler. [5+5]

**OR**

- 5.a) What is the effect of friction on nozzle.
- b) Distinguish between water-tube and fire-tube boilers and state under what circumstances each type would be desirable. [5+5]

- 6.a) What are the types of Condensers? Classify.  
b) A single-row impulse turbine develops 132.5 kW at a blade speed of 175 m/s when the steam flow rate is 120 kg/min. Steam leaves the nozzle at 400 m/s. Take blades velocity coefficient = 0.9 and assume that the steam leaves the turbine blades axially. Find out the nozzle angle, blade angles. Assume there is no shock. [5+5]  
**OR**
- 7.a) Explain working principle of Surface Condenser with neat sketch.  
b) A closed vessel of 0.7 m<sup>3</sup> capacity contains saturated water vapor and air at a temperature of 42.7 °C and a pressure of 0.13 bar abs. Due to further air leakage into the vessel, the pressure rises to 0.28 bar abs. and temperature falls to 37.6 °C. Calculate the mass of air which has leaked in. Take R=287J/kg K for air. [5+5]
- 8.a) Derive the thermal efficiency of an ideal gas turbine power plant.  
b) A gas turbine unit receives air at 100kPa and 300K and compresses it adiabatically to 620kPa with efficiency of the compressor 88%. The fuel has a heating value of 44,180kJ/kg and the fuel/air ratio is 0.017kg fuel/kg air. The turbine internal efficiency is 90%. Calculate the compressor work, turbine work and thermal efficiency. [5+5]  
**OR**
- 9.a) Explain the effect of regeneration, inter cooling, and reheating on the performance of Gas turbine plant.  
b) A gas turbine plant receives air at 1 bar and 290K and compresses it to 5bar. If the temperature of air after compression is 1000K. Find the thermal efficiency of the turbine. Take  $\gamma=1.4$  for air. [5+5]
- 10.a) State the fundamental difference between the jet propulsion and rocket propulsion.  
b) Derive the expressions for thermal efficiency of thrust and thrust power. [5+5]  
**OR**
- 11.a) Explain the principle and working of liquid propellant rocket engine with neat sketch.  
b) A jet plane having 2 jets works on turbo-jet system. It flies at a speed of 800km/hr at an altitude where density of air is 0.15 kg/m<sup>3</sup>. The propulsive efficiency is 55%. The drag on the plane is 6500N. Calculate i) Absolute velocity of jet ii) quantity of compressed air and iii) diameter of jet. [5+5]

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